JEFFRY D. VANN, PHD PE D.GE F.ASCE **CURRICULUM VITAE**

CURRENT POSITION:

Arizona State University DEWSC, Instructor for CON 450
Vann Engineering, Inc., Principal Engineer

IMMEDIATE GOAL:

To become a professor of practice and teach construction management and engineering; giving back to an industry that has formed the professional aspects of my life

REGISTRATION: PROFESSIONAL ENGINEER:

Arizona License 15206
Colorado License 31142
Nevada License 9741
Utah License 4788456-2202
Texas License 82197
New Mexico License 12992

FORMAL EDUCATION:

BS Geology, Arizona State University (1979)
MS Civil Engineering, Arizona State University (1984)
PhD Civil, Environmental and Sustainable Engineering, Arizona State University (May 6, 2019) - Dissertation Topic – "A Soil Suction-Oedometer Method and Design Soil Suction Profile Recommendations for Estimation of Volume Change of Expansive Soils"

PUBLICATIONS:

Houston, S.L., and Vann, J.D. (1987). "Methods of evaluating the expansion potential of compacted soils with significant fractions of large aggregate," Geotechnical Testing Journal, GTJODJ, Vol. 10, No.2, 59-70

Olaiz, A.H., Singhar, S.H., Vann, J.D., and Houston, S.L. (2017). "Comparison and applications of the Thornthwaite moisture index using GIS," PanAm Unsat, Second Pan-American Conference on Unsaturated Soils, Dallas, Texas, 280-289.

Vann, J.D., Houston, S., Houston, W., Singhar, S., Cuzme, A., and Olaiz, A. (2018). "A soil suction surrogate and its use in the suction-oedometer method for computation of volume change of expansive soil," The 7th International Conference on Unsaturated Soils, Hong Kong, 1205-1210.

Vann, J.D. (2019). "A soil suction-oedometer method and design soil suction recommendations for estimation of volume change of expansive soils," PhD Dissertation, Arizona State University, Tempe, AZ.

Vann, J.D., Olaiz, A.H., Morgan, S.J. and Zapata, C. (2019). "A practical approach to a reliability -based stability evaluation of precariously balanced granite boulders," 53rd US Rock Mechanics Geomechanics Symposium, 2019 Symposium, ARMA 19-134, New York, NY.

PROFESSIONAL AFFILIATIONS:

Fellow - American Society of Civil Engineers, Member Since 1985
Diplomat – Geotechnical Engineering, American Society of Civil Engineers
Arizona Board of Technical Registration Enforcement Advisory Committee
American Society of Testing & Materials

Geological Society of America
ADSC Member, Maroon Member of the Sun Devil Club, Lifetime ASU Alumni Member

PROFESSIONAL AREAS OF SPECIALTY:

Unsaturated Soil Mechanics
Shallow Spread Foundations on Expansive Soil, Rock, Collapsible Soil
Drilled Shaft Foundations in Soil and Rock
Rock Mechanics in association with rock slopes, hillside boulder stability, and remedial action measures
Earthquake Engineering
Excavation Stability Using Soil Nails and Soldier Pile Walls
Soil and Rock Slope Stability Utilizing Catch Fencing, Mesh Draping, Bolting
Design of MSE Walls
Design of Micropiles, Push Piers, Helical piers and Geopiers

TEACHING AND SPEAKING EXPERIENCE:

Arizona State University – Current instructor for CON 450 Geotechnical Applications for Construction
Arizona State University – Substitute teaching for CEE-351 Soil Mechanics
Arizona State University – Substitute teaching for CEE-452 Foundations
Arizona State University – Substitute teaching for CEE-550 Soil Behavior
Arizona State University – Substitute teaching for CEE-598 Soil Improvement
Arizona State University – Guest lecturing on expansive soils, collapsible soils, forensic geotechnical engineering and case studies
2016 ASCE ASHE Annual Conference Committee Speaker – September 2016 – Understanding the Forensic Process
Paper presentation in Hong Kong, August 2018, (Vann et al., 2018) 7th International Conference on Unsaturated Soils
Paper presentation in Brooklyn, NY, June 2019, (Vann et al., 2019) American Association of Rock Mechanics, 53rd ARMA Symposium

COMPUTER / SOFTWARE PROFICIENCY:

SHAFT, LPILE, Slide2, ReMi, Slope/W, VOLFLO, A-Pile, RocFall, CRSP, S-Wedge, RocTopple, Dips, Pickwin, Plotrefa, SeisImager, MSEW, DeepEX, SNAIL, Shoring8, Retwall, Blastmate, Cloud-based computing, Adobe, and the full suite of Microsoft Office

REPRESENTATIVE WORK EXPERIENCE:

- In 39 years, over 26,000 geotechnical projects have been supervised
- Types of projects include hospitals and medical facilities, schools, single family residential subdivisions, retail centers, apartments and condominiums, office buildings, fire stations, automobile retailers, transportation facilities, resorts and hotels, waste / wastewater facilities, mines, communications facilities, churches, roadways, silos and solar and wind farms
- Types of geotechnical and environmental studies completed:
- Shallow spread footing design for structures ranging from lightly to heavily loaded shallow and semi-deep footing design
- Phase 1, Phase 2 and Phase 3 environmental site assessments, along with remedial action plans and supervision of vadose zone and groundwater remediation

- Forensic geotechnical investigations including recommendations for foundation and slab repair
- Post-tensioned slab design for lightly loaded and moderately loaded structures
- Drilled shaft design in soil and rock, with and without groundwater, with particular focus on axial capacity, uplift capacity, base shear and overturning moment
- Retaining wall design pertaining to soil and rock, with particular attention to hillside conditions
- Mechanically stability earth walls
- Scour analyses
- Recommendations for sloped, braced and reinforced excavations
- Detailed rock slope stability analyses, rock bolting, catch fences
- Granite boulder stabilities investigations and remedial action recommendations
- Earthquake engineering
- Subsurface seepage studies with regard to septic and retention design
- Roadway design for streets, with emphasis on asphalt and concrete sections
- Completion of land subsidence and detailed earth fissure studies
- Marina and terminal design recommendations
- Helical pier, push pier and micropile design
- Expert witness studies related to expansive soils, settlement of backfill, retaining wall failures, and fill slope movements
- Geotechnical and environmental studies have been completed for locations in Arizona, New Mexico, Colorado, Utah, Texas, Nevada, Barbados and Indonesia

The following table demonstrates the wide scope of project types completed:

HOSPITALS AND MEDICAL FACILITIES	SCHOOLS	SINGLE-FAMILY RESIDENTIAL
Kingman Medical Plaza, Kingman, AZ Cancer Center Kingman Regional Medical Center, Kingman, AZ Mohave Mental Health Medical Mall & Development, Kingman, AZ Kingman Senior Living Facility, Kingman, AZ Mohave Senior Living Center, Kingman, AZ Memory Care & Assisted Living Facility, Kingman, AZ Additions to Kingman Regional Medical, Kingman, AZ Arizona Heart Hospital, Phoenix, AZ Additions to Banner Good Samaritan Hospital, Phoenix, AZ West Valley Medical Center Ahwatukee Medical Center, Phoenix, AZ Broadway Medical Center, Phoenix, AZ Mayo Medical, Scottsdale, AZ	Nursing School Building, Mohave Community College, Kingman, AZ Rad Tech Building, Mohave Community College, Kingman, AZ Student Services Building, Mohave Community College, Kingman, AZ ASU Lattie F. Coor Mediated Classrooms & Social Sciences Hall, Tempe, AZ ASU Residence Life at South Campus, Tempe, AZ Tesseract School, Phoenix, AZ Maryvale High School, Phoenix, AZ Cartwright Elementary and Middle School, Phoenix, AZ	Hualapai Mountain Park RV Park Extension, Mohave County Legacy at Walleck Ranch, Mohave County Castle Rock Village Tract 1990, Kingman, AZ Box Canyon Subdivision, Mohave County Salvation Trails Subdivision, Mohave County Cerbat Vistas Subdivision, Kingman, AZ Walnut Creek Estates, Kingman, AZ Rancho Santa Fe Tract 1953, Kingman, AZ Westpark Community, Buckeye, AZ Desert Fountain Estates II, Kingman, AZ Housing America Estates II, Kingman, AZ Boulders Casitas, Scottsdale, AZ Newport Manor Subdivision, Phoenix, AZ

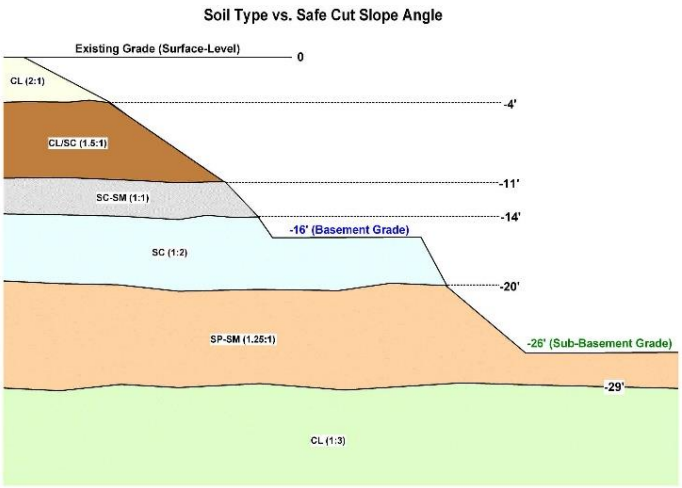
RETAIL CENTERS	APARTMENTS AND CONDOMINIUMS	OFFICE BUILDINGS
Western Airway Retail Building, Kingman, AZ Dollar General Stores across AZ Pollack Business Park North, Chandler, AZ Pollack Paseo del Oro, Chandler, AZ Picazzo Plaza, Tempe, AZ Pleasant Promenade Retail Center, Peoria, AZ Spur Cross Retail, Carefree, AZ PING Expansion, Phoenix, AZ	Bello Nova Condominiums, Mohave County Jagerson Apartments, Kingman, AZ Grigio Tempe Town Lake, Tempe, AZ Camelback Square, Phoenix, AZ Artisan Lofts on Central, Phoenix, AZ Landmark Apartments, Scottsdale, AZ Acclaim Apartment Homes, Phoenix, AZ Cortese Apartments, Fountain Hills, AZ	Mohave Estates Management Office, Kingman, AZ Mohave County Development Services, Kingman, AZ ADOT Transportation Services Group, Kingman, AZ Camelhead, Phoenix AZ Prudential Building, Scottsdale, AZ Scottsdale Galleria, Scottsdale, AZ Market Echo Office Plaza, Phoenix, AZ UMB Wealth Management Office, Phoenix, AZ
WATER/WASTEWATER FACILITIES	**CHURCHES**	**RESORTS & HOTELS**
Stockton Hill Road Water Line Replacement; May 2018 – Project 25876 Mohave County 31 Miles Water Pipeline Rehabilitation and Water Tank, Peach Springs, AZ City of Florence Wastewater Treatment Plant City of Mesa Wastewater Treatment Plant City of Phoenix Water Treatment Plant Chinle Water Treatment Plant	Journey Church, Kingman, AZ Phoenix First Assembly Youth Pavilion, Phoenix, AZ Trinity Lutheran Church Addition, Phoenix, AZ Vineyard Church North Phoenix Campus Expansion, Peoria, AZ Gilbert LDS Temple, Gilbert, AZ Phoenix LDS Temple, Phoenix, AZ Baptist Church, Peoria, AZ	Island Inn Hotel, Kingman, AZ Hyatt Pinon Pointe Vacation Club and Resort, Sedona, AZ Clarion Hotel Airport, Tucson, AZ Springhill Suites Phoenix Tempe/Airport, Tempe, AZ San Carlos Hotel, Phoenix, AZ Pointe Hilton, Phoenix, AZ Casino Del Sol Expansion, Tucson, AZ
FIRE STATIONS	**AUTOMOTIVE AND MOTORCYCLE**	**TRANSPORTATION**
Glendale Fire Station No. 157, Glendale, AZ Peoria Fire Station No. 3, Peoria, AZ Surprise Fire Station No. 303, Surprise, AZ Communications Facility - Hose Tower, Oro Valley, AZ Northwest Fire Station #32, Tucson, AZ	Freedom Truck Wash, Kingman, AZ Blue Beacon Truck Wash & Motel, Kingman, AZ Liberty Kia, Prescott Valley, Arizona Freeway Chevrolet, Chandler, AZ Superstar Carwash, Phoenix, AZ Buddy Stubbs Arizona Harley-Davidson, Phoenix, AZ Arrowhead Harley-Davidson, Peoria, AZ Peoria Nissan, Peoria, AZ	Six-shooter Road and Bridge - Globe, AZ West Street, Flagstaff, AZ Monroe Road, Globe, AZ SR95 and Mulberry, Lake Havasu, AZ Sullivan Street, Miami, AZ Empire Avenue, Flagstaff, AZ Valley Metro Bus Maintenance Facility, Tempe, AZ
ARTS & ENTERTAINMENT FACILITIES	**MINE/LANDFILLS**	**FINANCIAL INSTITUTIONS**
Thunderbird Mountain Sky-Rider Aerial Adventure Course, Mohave County Mesa Arts & Entertainment Center, Mesa, AZ Heard Museum Fine Arts Building, Phoenix, AZ Sun Bowl Amphitheatre, Sun City, AZ	M.R. Tanner Mine Quartzsite Mill Site Mineral Park Mine Contractors Landfill Minnesota Methane Phoenix Energy Glen Wineburger Landfill	Mission Bank, Kingman, AZ Bank of America Parking Structure, Phoenix, AZ National Bank of Arizona Deer Valley Branch, Phoenix, AZ Arizona Bank & Trust Building, Phoenix, AZ

TELECOMMUNICATIONS FACILITIES	SOLAR/WINDFARMS	PAVEMENT THICKNESS DESIGN
Aubrey Peak, Mohave County Highway 93 & Cedar Mine Road, Mohave County Stone Canyon Maintenance Yard, Kingman, AZ Dunton Ranch, Kingman, AZ AZ1 Willow Ranch, Kingman, AZ AZ1 Race Track, Kingman, AZ AZ1 Calle Blanca, Kingman, AZ	Mohave Sunrise Solar Phase I, Mohave County, AZ Kingman II Windfarm, Kingman, AZ Valley View Solar Array Facility Phase I, Kingman, AZ	Santa Fe Ranch Road, Kingman, AZ City of Kingman Berk Avenue Sewer Line Extension, Kingman, AZ

Relevant Geotechnical Engineering Project of Jeffry D. Vann

Gilbert Arizona LDS Temple

Jeffry D. Vann was the principal geotechnical engineer for the Gilbert Arizona LDS Tempe in Gilbert, Arizona. The proposed temple involved maximum column loads of 500 kips. The structure was three levels above ground and two levels below. An extremely long design life was imposed on the project.



The relevant scope of services for this project included supervision of the test boring layout and interpretation of the subsurface stratigraphy, explanation of applicable geologic hazards, explanation of frost penetration depth and effect, laboratory testing of all samples obtained during the field investigation, perform a geotechnical engineering analysis for the proposed project based on all data obtained from the site (e.g. laboratory test results and the subsurface investigation), recommendations for excavation cut slope stability, recommendations for soil nailing, recommendations for conventional surface-level spread foundations; allowable soil bearing capacity based on a settlement analysis of ½ inch total settlement and ½ inch differential settlement, recommendations for conventional basement-level spread foundations at or below 10 and 15 feet; allowable soil bearing capacity based on a settlement analysis of ½ inch total settlement and ¼ inch differential settlement, recommendations for conventional sub-basement-level spread foundations at or below 20 feet; allowable soil bearing capacity based on a settlement analysis of ½ inch total settlement and ¼ inch differential settlement, recommendations for drilled shaft foundations bearing at or below 16.0 feet, recommendations for drilled shaft foundations bearing at or below 26.0 feet, general excavation conditions, anticipated shrinkage of the surface soils, lateral stability analysis including active pressure, passive pressure and base friction, recommendations for site grading, determination of the potential for corrosion attributed to the soil, recommendations for drainage and slab support, recommendations for on-site and off-site pavement thickness design, recommendations for site retention percolation, determination of the applicable seismic constraints, all excavation slope stability inspections, fill control, and all special inspections for the project on behalf of the owner.

Casino De Sol

Jeffry D. Vann was the principal geotechnical engineer for significant additions to Casino del Sol in Tucson, Arizona. The clear majority of the work occurred in 2009 and 2010. The proposed expansion to the casino includes a 10-story hotel, a 4-story parking garage, conference center, warehouse, swimming pool, and modifications to the existing parking and retention areas. The maximum column and wall loads are as summarized below.

	Maximum Column Load (KIPS)	Maximum Wall Load (KLF)
Conventional, shallow, lightly loaded surface-level spread foundations bearing on native undisturbed soil with total and differential settlements limited to ½ inch and ¼ inch, respectively. Primarily, this refers to the warehouse and conference center.	150	10
4-Story Parking Garage, heavily loaded surface-level spread foundations with total and differential settlements limited to ¾ inch and ½ inch, respectively.	1500	100
10-Story Hotel and 4-Story Parking Garage, heavily loaded drilled shaft foundations with total and differential settlements limited to ½ inch and ¼ inch, respectively.	1500	100

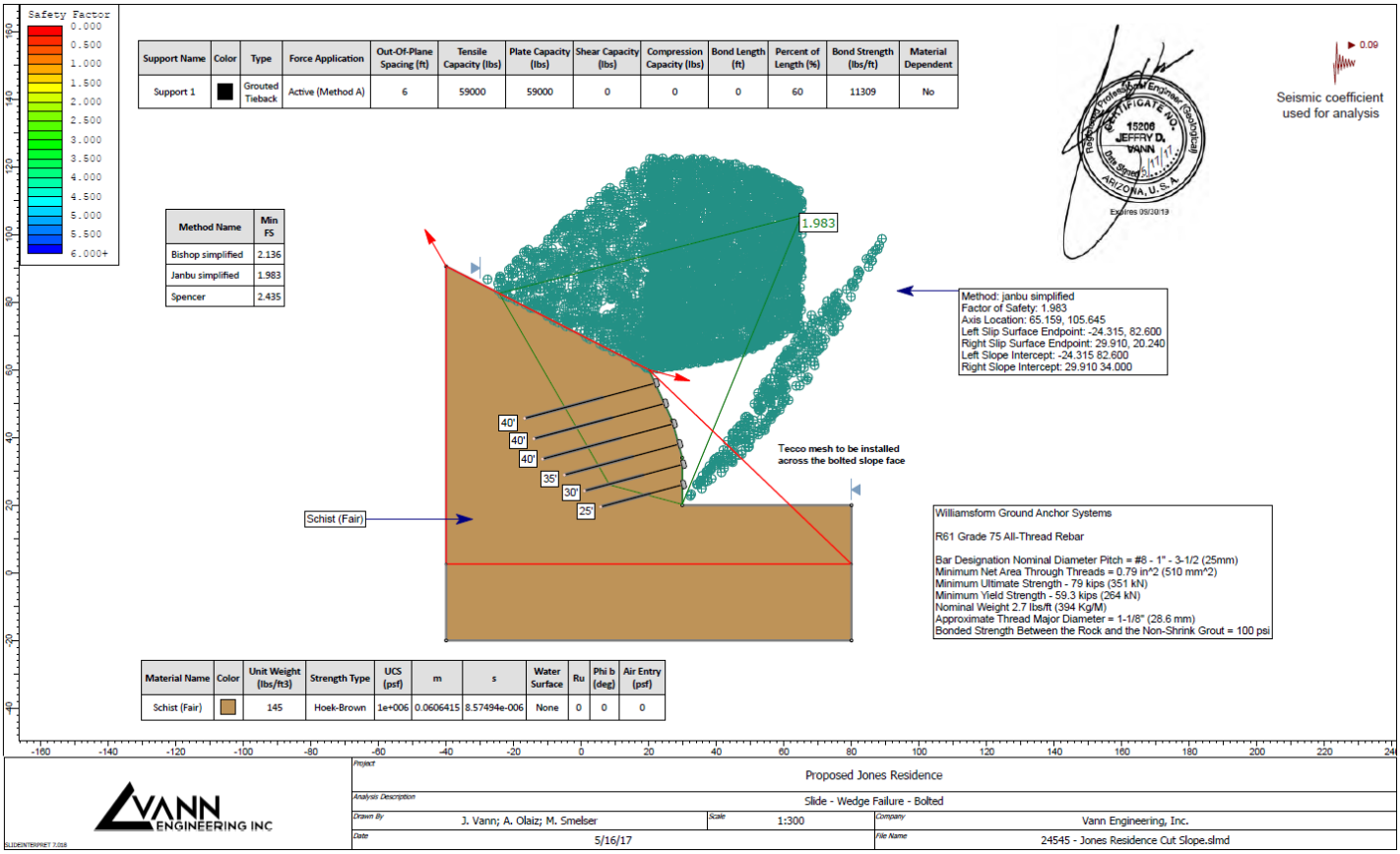
The relevant scope of services for this project included supervision of the test boring layout and interpretation of the subsurface stratigraphy, determination of the appropriate seismic S-wave velocity of the site using microtremor and dispersion analysis (ReMi), recommendations for surface-level lightly loaded conventional spread foundations with an allowable soil bearing capacity based on a settlement analysis of ½ inch total settlement and ¼ inch differential settlement, recommendations for heavily loaded surface-level conventional spread foundations for allowable soil bearing capacity based on a settlement analysis of ¾ inch total settlement and ½ inch differential settlement, recommendations for moment resisting drilled shafts (4‘ to 6’ diameter) with both axial and uplift capacities, accompanied by full lateral load analysis with moment/shear/deflection data for each diameter (4-Story Parking Garage and 10-Story Hotel), recommendations for modulus of subgrade reaction, design of thickened slab systems, general excavation conditions and support alternatives, lateral stability analysis including active pressure, passive pressure and base friction, recommendations for site grading, recommendations for drainage and slab support, recommendations for pavement thickness design, recommendations for tower crane foundation design, fill control monitoring, foundation inspection for spread footings and drilled shaft foundations, and all other material qualifications testing for the owner.

Jones Residence – Rock Slope Stability Analysis

Jeffry D. Vann was the principal geotechnical engineer for the proposed stabilization to the rock cut slope for the Jones Residence to be located at 6936 North Mummy Mountain Road in Paradise Valley, Arizona.

The project involved the detailed analysis of the existing rock slope, determination of the existing stability and generation of recommendations for remedial action to make the slope stable for the homeowners.

The rock bolting pattern needed to stabilize the slope is provided below:

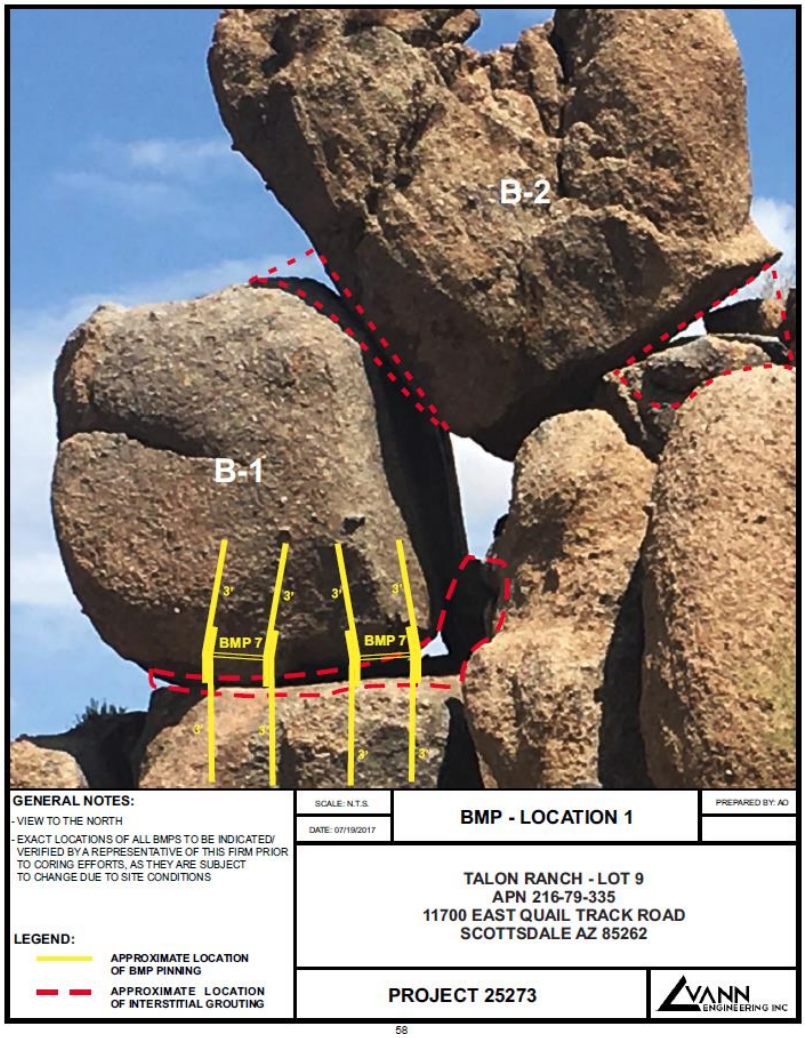


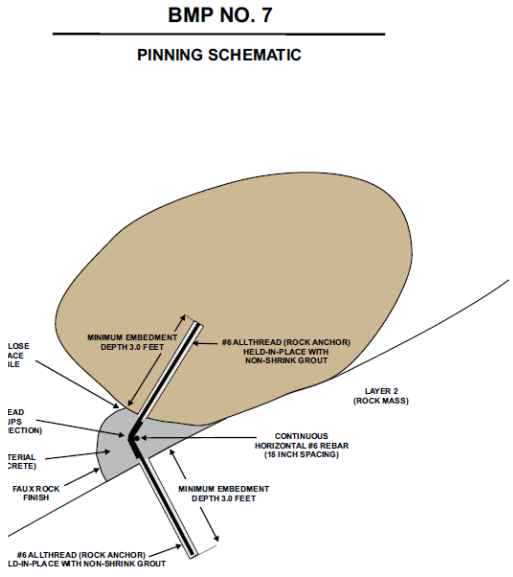
Kipers Residence – Boulder Stability Analysis and Remedial Action

Jeffry D. Vann was the principal geotechnical engineer for the stabilization of boulders at the Kipers Residence in Scottsdale, Arizona.

The project involved the detailed analysis of the existing granite boulder formation, determination of the existing stability and generation of recommendations for remedial action to ensure stability for the homeowners.

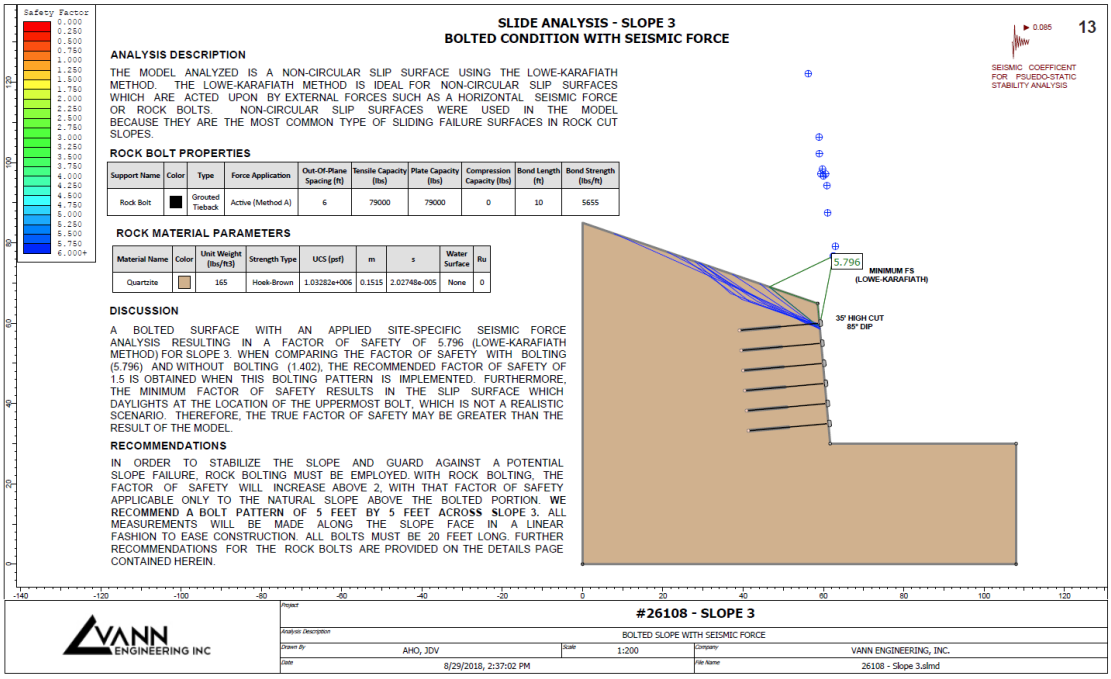
The pinning utilized to stabilize the granite boulders is presented as follows:





Mackos Residence – Rock Slope Stability Analysis

Images relevant to the project include the following:



SLIDE ANALYSIS - SLOPE 3
BOLTED CONDITION WITH SEISMIC FORCE

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SEISMIC COEFFICENT FOR PSUEDO-STATIC STABILITY ANALYSIS

ANALYSIS DESCRIPTION

THE MODEL ANALYZED IS A NON-CIRCULAR SLIP SURFACE USING THE LOWE-KARAFIATH METHOD. THE LOWE-KARAFIATH METHOD IS IDEAL FOR NON-CIRCULAR SLIP SURFACES WHICH ARE ACTED UPON BY EXTERNAL FORCES SUCH AS A HORIZONTAL SEISMIC FORCE OR ROCK BOLTS. NON-CIRCULAR SLIP SURFACES WERE USED IN THE MODEL BECAUSE THEY ARE THE MOST COMMON TYPE OF SLIDING FAILURE SURFACES IN ROCK CUT SLOPES.

ROCK BOLT PROPERTIES

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Compression Capacity (lbs)	Bond Length (ft)	Bond Strength (lbs/ft)
Rock Bolt		Grouted Tieback	Active (Method A)	6	79000	79000	0	10	5655

ROCK MATERIAL PARAMETERS

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)	m	s	Water Surface	Ru
Quartzite		165	Hoek-Brown	1.03282e+006	0.1515	2.02748e-005	None	0

DISCUSSION

A BOLTED SURFACE WITH AN APPLIED SITE-SPECIFIC SEISMIC FORCE ANALYSIS RESULTING IN A FACTOR OF SAFETY OF 5.796 (LOWE-KARAFIATH METHOD) FOR SLOPE 3. WHEN COMPARING THE FACTOR OF SAFETY WITH BOLTING (5.796) AND WITHOUT BOLTING (1.402), THE RECOMMENDED FACTOR OF SAFETY OF 1.5 IS OBTAINED WHEN THIS BOLTING PATTERN IS IMPLEMENTED. FURTHERMORE, THE MINIMUM FACTOR OF SAFETY RESULTS IN THE SLIP SURFACE WHICH DAYLIGHTS AT THE LOCATION OF THE UPPERMOST BOLT, WHICH IS NOT A REALISTIC SCENARIO. THEREFORE, THE TRUE FACTOR OF SAFETY MAY BE GREATER THAN THE RESULT OF THE MODEL.

RECOMMENDATIONS

IN ORDER TO STABILIZE THE SLOPE AND GUARD AGAINST A POTENTIAL SLOPE FAILURE, ROCK BOLTING MUST BE EMPLOYED. WITH ROCK BOLTING, THE FACTOR OF SAFETY WILL INCREASE ABOVE 2, WITH THAT FACTOR OF SAFETY APPLICABLE ONLY TO THE NATURAL SLOPE ABOVE THE BOLTED PORTION. **WE RECOMMEND A BOLT PATTERN OF 5 FEET BY 5 FEET ACROSS SLOPE 3.** ALL MEASUREMENTS WILL BE MADE ALONG THE SLOPE FACE IN A LINEAR FASHION TO EASE CONSTRUCTION. ALL BOLTS MUST BE 20 FEET LONG. FURTHER RECOMMENDATIONS FOR THE ROCK BOLTS ARE PROVIDED ON THE DETAILS PAGE CONTAINED HEREIN.

5.796 MINIMUM FS (LOWE-KARAFIATH)

35' HIGH CUT 85° DIP

VANN ENGINEERING INC

#26108 - SLOPE 3

BOLTED SLOPE WITH SEISMIC FORCE

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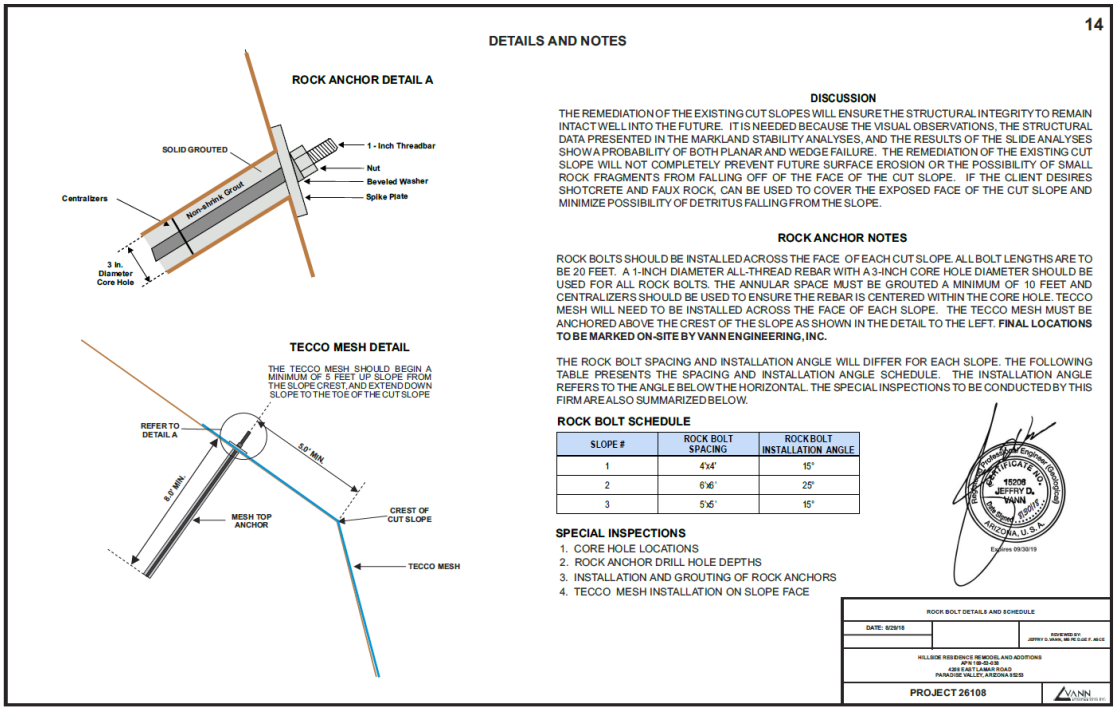

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DETAILS AND NOTES

ROCK ANCHOR DETAIL A

SOLID GROUTED
1 - Inch Threadbar
Nut
Beveled Washer
Spike Plate
Centralizers
Non-shrink Grout
3 in. Diameter Core Hole

TECCO MESH DETAIL

THE TECCO MESH SHOULD BEGIN A MINIMUM OF 5 FEET UP SLOPE FROM THE SLOPE CREST, AND EXTEND DOWN SLOPE TO THE TOE OF THE CUT SLOPE
REFER TO DETAIL A
5.0' MIN.
8.0' MIN.
MESH TOP ANCHOR
CREST OF CUT SLOPE
TECCO MESH

DISCUSSION

THE REMEDIATION OF THE EXISTING CUT SLOPES WILL ENSURE THE STRUCTURAL INTEGRITY TO REMAIN INTACT WELL INTO THE FUTURE. IT IS NEEDED BECAUSE THE VISUAL OBSERVATIONS, THE STRUCTURAL DATA PRESENTED IN THE MARKLAND STABILITY ANALYSES, AND THE RESULTS OF THE SLIDE ANALYSES SHOW A PROBABILITY OF BOTH PLANAR AND WEDGE FAILURE. THE REMEDIATION OF THE EXISTING CUT SLOPE WILL NOT COMPLETELY PREVENT FUTURE SURFACE EROSION OR THE POSSIBILITY OF SMALL ROCK FRAGMENTS FROM FALLING OFF OF THE FACE OF THE CUT SLOPE. IF THE CLIENT DESIRES SHOTCRETE AND FAUX ROCK, CAN BE USED TO COVER THE EXPOSED FACE OF THE CUT SLOPE AND MINIMIZE POSSIBILITY OF DETRITUS FALLING FROM THE SLOPE.

ROCK ANCHOR NOTES

ROCK BOLTS SHOULD BE INSTALLED ACROSS THE FACE OF EACH CUT SLOPE. ALL BOLT LENGTHS ARE TO BE 20 FEET. A 1-INCH DIAMETER ALL-THREAD REBAR WITH A 3-INCH CORE HOLE DIAMETER SHOULD BE USED FOR ALL ROCK BOLTS. THE ANNULAR SPACE MUST BE GROUTED A MINIMUM OF 10 FEET AND CENTRALIZERS SHOULD BE USED TO ENSURE THE REBAR IS CENTERED WITHIN THE CORE HOLE. TECCO MESH WILL NEED TO BE INSTALLED ACROSS THE FACE OF EACH SLOPE. THE TECCO MESH MUST BE ANCHORED ABOVE THE CREST OF THE SLOPE AS SHOWN IN THE DETAIL TO THE LEFT. **FINAL LOCATIONS TO BE MARKED ON-SITE BY VANN ENGINEERING, INC.**

THE ROCK BOLT SPACING AND INSTALLATION ANGLE WILL DIFFER FOR EACH SLOPE. THE FOLLOWING TABLE PRESENTS THE SPACING AND INSTALLATION ANGLE SCHEDULE. THE INSTALLATION ANGLE REFERS TO THE ANGLE BELOW THE HORIZONTAL. THE SPECIAL INSPECTIONS TO BE CONDUCTED BY THIS FIRM ARE ALSO SUMMARIZED BELOW.

ROCK BOLT SCHEDULE

SLOPE #	ROCK BOLT SPACING	ROCK BOLT INSTALLATION ANGLE
1	4'x4'	15°
2	6'x6'	25°
3	5'x5'	15°

SPECIAL INSPECTIONS

1. CORE HOLE LOCATIONS
2. ROCK ANCHOR DRILL HOLE DEPTHS
3. INSTALLATION AND GROUTING OF ROCK ANCHORS
4. TECCO MESH INSTALLATION ON SLOPE FACE

ROCK BOLT DETAILS AND SCHEDULE

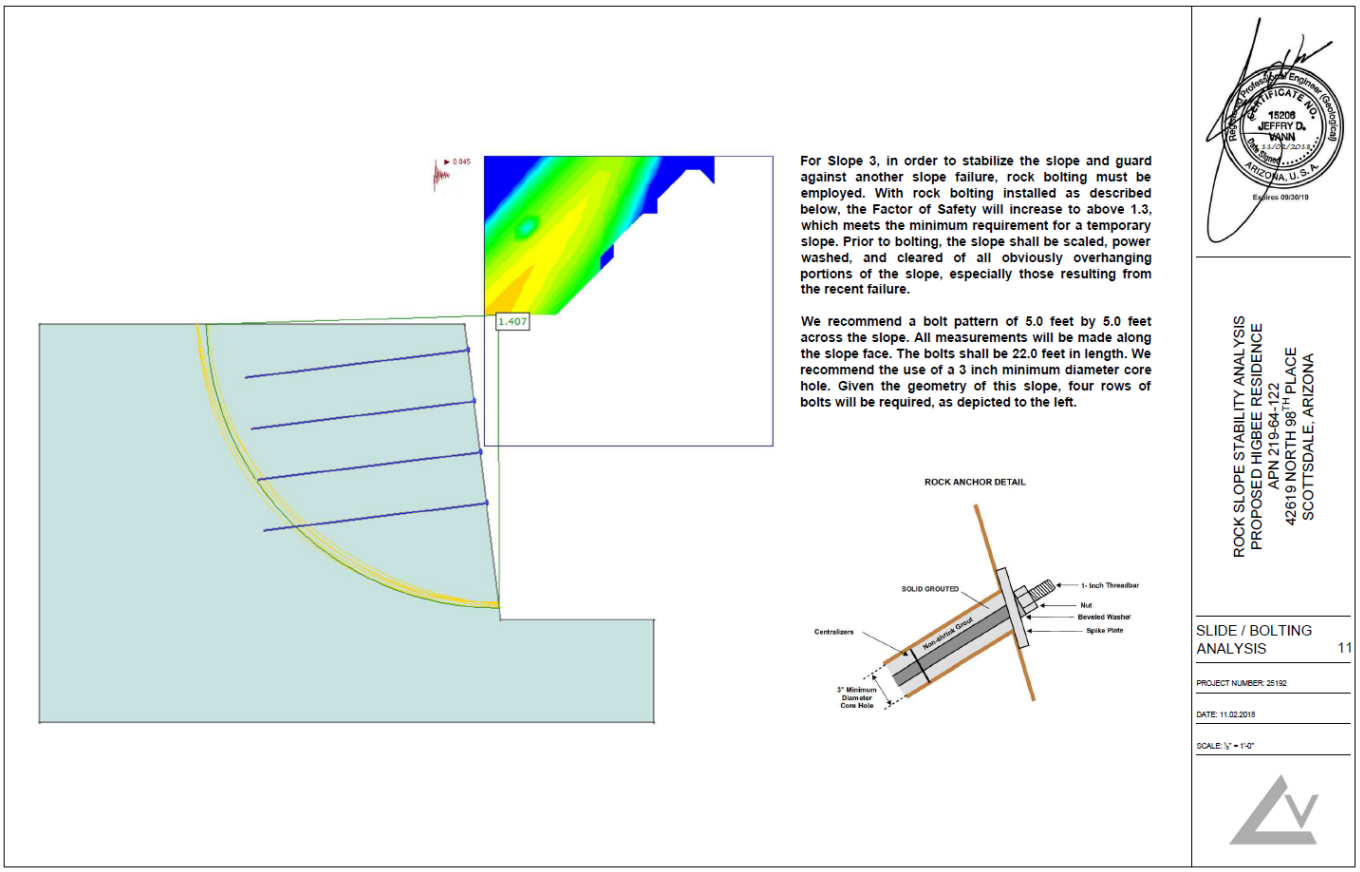
DATE: 8/29/18

HILLSIDE RESIDENCE REMODEL AND ADDITIONS
APN 169-32-030
4265 E ALTA LAMA ROAD
PARADISE VALLEY, ARIZONA 85253

PROJECT 26108

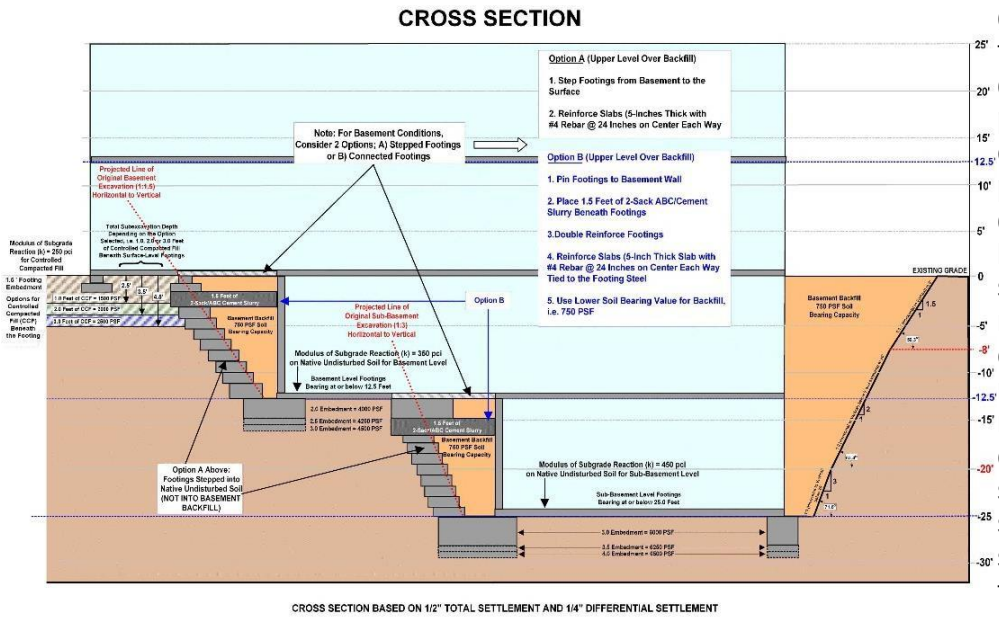
Higbee Residence – Rock Slope Stability Analysis

The following images constitute a portion of the rock slope stability analysis that was required to stabilize a basement excavation that was mistakingly cut to near vertical:



Phoenix Arizona LDS Temple

Jeffry D. Vann was the principal geotechnical engineer for the Phoenix Arizona Tempe in Phoenix, Arizona. The proposed temple involved maximum column loads of 400 kips. The structure was two levels above ground and two levels below. An extremely long design life was imposed on the project. The relevant scope of services for this project included supervision of the test boring layout and interpretation of the subsurface stratigraphy, explanation of applicable geologic hazards, laboratory testing of all samples obtained during the field investigation, perform a geotechnical engineering analysis for the proposed project based on all data obtained from the site (e.g. laboratory test results and the subsurface investigation), recommendations for excavation cut slope stability, recommendations for soil nailing, recommendations for conventional surface-level spread foundations; allowable soil bearing capacity based on a settlement analysis of ½ inch total settlement and ½ inch differential settlement,

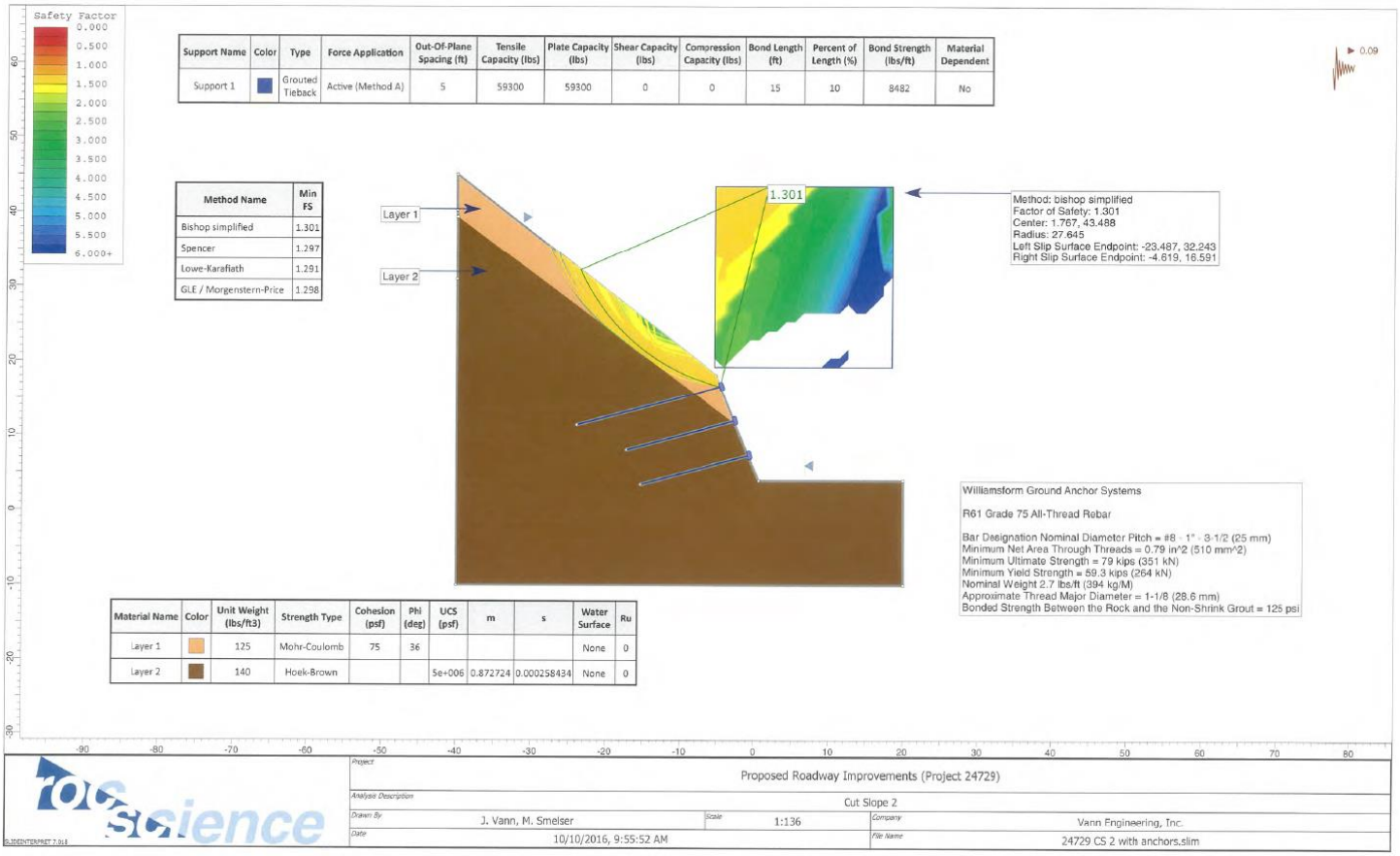


CROSS SECTION BASED ON 1/2" TOTAL SETTLEMENT AND 1/4" DIFFERENTIAL SETTLEMENT

recommendations for conventional basement-level spread foundations at or below 12.5 feet; allowable soil bearing capacity based on a settlement analysis of ½ inch total settlement and ¼ inch differential settlement, recommendations for conventional sub-basement-level spread foundations at or below 25 feet; allowable soil bearing capacity based on a settlement analysis of ½ inch total settlement and ¼ inch differential settlement, general excavation conditions, anticipated shrinkage of the surface soils, lateral stability analysis including active pressure, passive pressure and base friction, recommendations for site grading, determination of the potential for corrosion attributed to the soil, recommendations for drainage and slab support, recommendations for on-site and off-site pavement thickness design, recommendations for site retention percolation, determination of the applicable seismic constraints, all excavation slope stability inspections, fill control, and special inspections for the project on behalf of the owner.

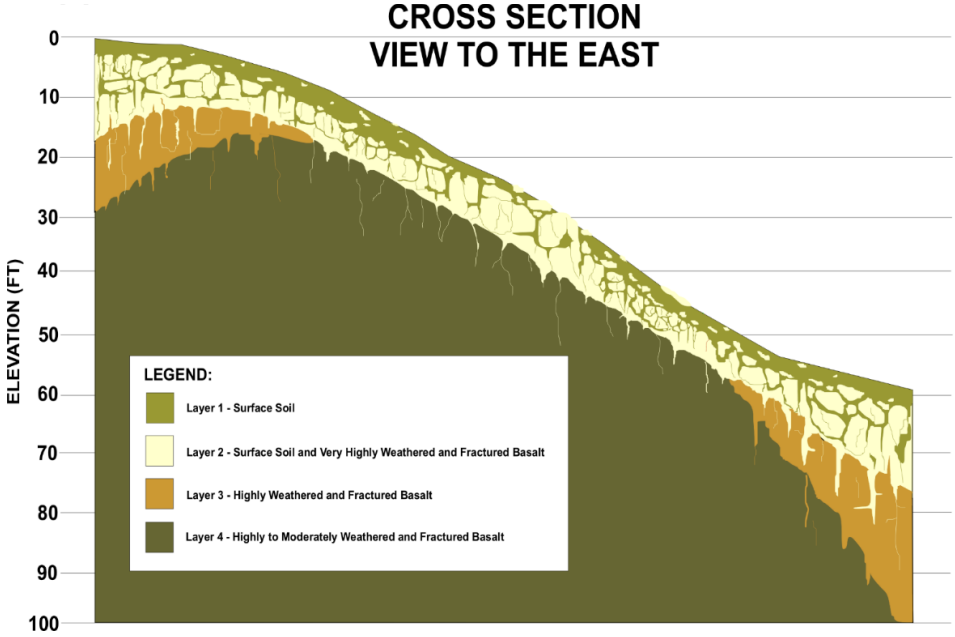
Roadway Improvements – Rock Slope Stability Analysis – 7570 North Silvercrest Way, Paradise Valley

The following images show the analysis of a cut slope that was to be modified to account for a roadway widening effort:



Railroad Springs Townhomes

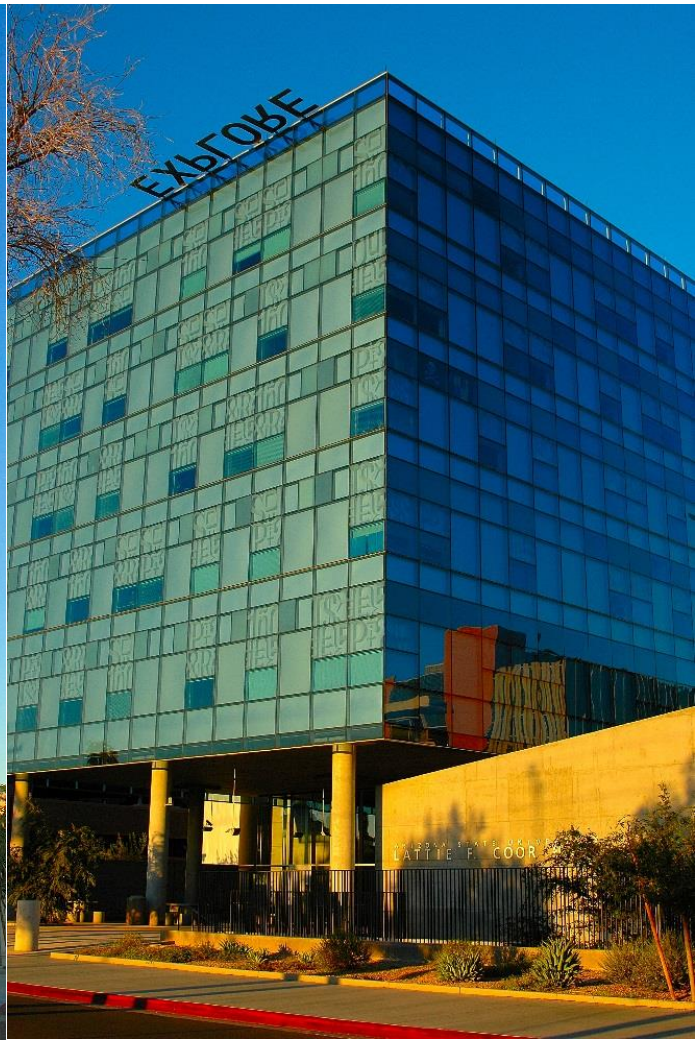
Jeffry D. Vann was the principal geotechnical engineer for the existing three-story townhome development in Flagstaff, Arizona. The project is situated on a complex hillside comprised of extremely expansive soils directly overlying basalt rock. Recommendations for foundations utilized knowledge of the zone of wetting, depth to constant suction and vertical extent of the surface clay layer to establish the needed foundation embedment depth of 78 inches below the existing site grade. The semi-deep spread foundations also assisted in maintaining requisite slope stability. Structural slabs cast on void form boxes were utilized to bridge over the heaving clays and allow for continued swelling of the clay in the collapsed void forms. The thickness of the void forms was designed as 8 inches to account for at least 4 inches of potential heave into the annular space below the structural slab. Phase 1 of the project was completed in 2007, with Phase 2 currently under construction.



ASU Lattie F. Coor Mediated Classrooms & Social Sciences Hall, Tempe, AZ

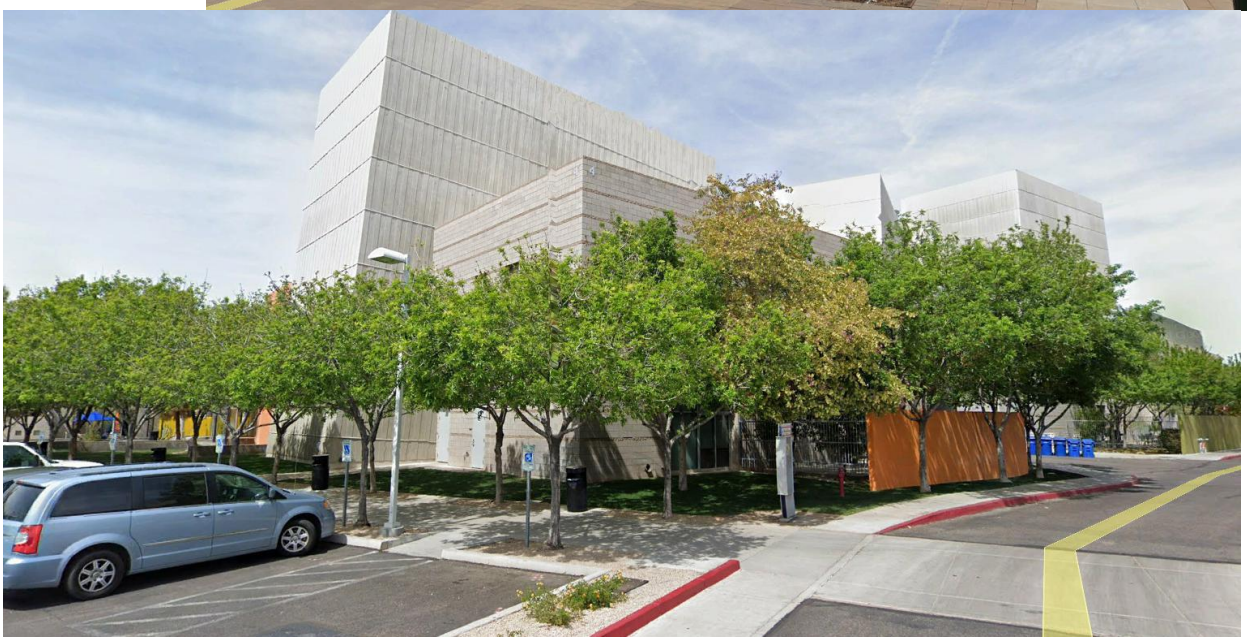
A six story above grade plus one sub-level comprised the scope of the project. All basement-level foundations were placed on large spread foundations to accommodate maximum column loads of 2000 kips. Drilled shaft foundations were utilized for the surface-level loading conditions, where large spans were designed.

Excavation slope stability was a prime concern as the subsurface soil layer below 10 feet was comprised of river sand, gravel and cobbles associated with the ancient course of the Salt River.



Mesa Arts and Entertainment Center

DWL Architects and Planners, Inc. was the architect for the project that services as the hub of performing arts in Mesa, Arizona. Located at 1 East Main Street in Mesa, AZ, orchestral as well as musicals and other headlining acts perform there. The structures feature one level below grade to accommodate the orchestra pit, heavily loaded spread foundations and drilled shaft foundations carrying loads in excess of 2000 kips arising from the large spans. Soil stabilization of the excavation cut slope involved a range of solutions including soldier piles and shotcrete slopes. Crane foundation design was of paramount importance.



The Muse

An inspired urban living facility was constructed in downtown Phoenix, within the arts district. A four-story parking garage was built at the northwest corner of the site. Four story multi-family buildings were built around, but not directly connected to the parking garage. Access to the buildings via the parking garage was made possible by elevated bridges. The maximum column loads are 1000 kips for the parking garage, which are supported by 5 feet deep spread foundations. The apartment dwellings are supported by post-tensioned slabs on ground.

ASU Residence Life at South Campus, Tempe, AZ

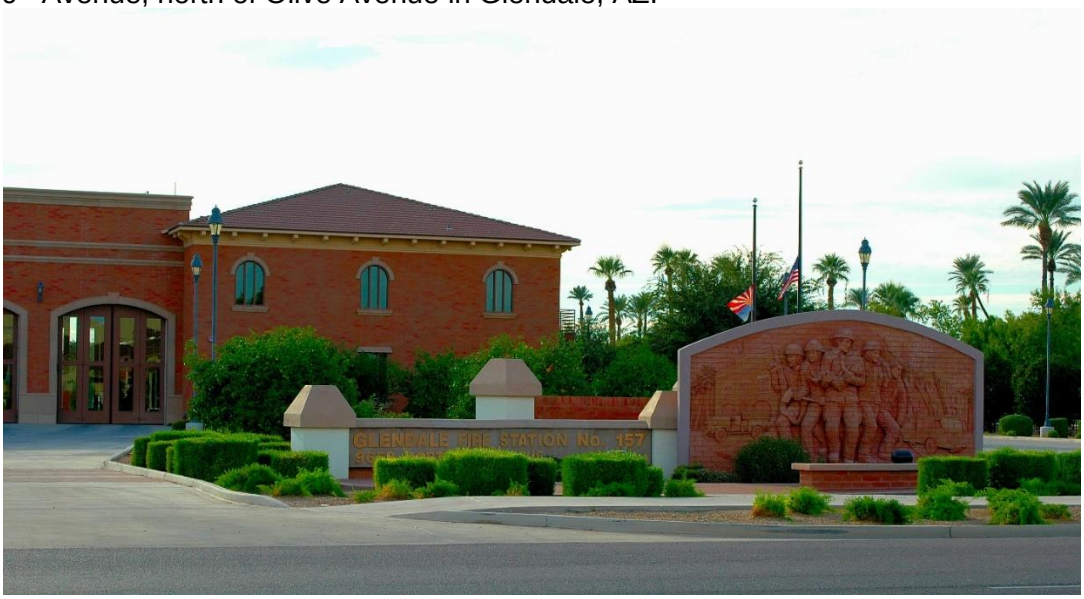
A three story above-grade residence hall was constructed for Arizona State University, involving spread foundations on engineered fill.

Scottsdale Galleria

Once a key upscale shopping center has become more of an art walk. The structure is built on a combination of drilled shafts and very heavily loaded spread foundations capable of carrying 2000 kips. Of note are the three levels below grade, 36 feet to the dredge line, which required extensive slope stability design and mitigation measures.

Glendale Fire Station #157

A landmark fire station in Glendale, AZ was constructed that honors first responders. The site is located on the west side of 59th Avenue, north of Olive Avenue in Glendale, AZ.



District at Scottsdale – Phases I and II

Four and five story post-tensioned slab apartment buildings wrapping a parking garage, also with four to five stories. The parking garage is recessed one level below grade. The heavily loaded parking garage foundations, 1300 kips maximum column loads, are supported by 5 feet embedded spread foundations. Other site concerns included soldier pile wall design, sloping excavating backfill, protection of adjacent facilities.


DISTRICT AT SCOTTSDALE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Banner Estrella Medical Center

A heavily loaded medical center involving drilled shaft foundations and deep spread footing were utilized to support the imposed loads.

Central and Columbus

Located at the northeast corner of Central Avenue and Columbus Avenue in Phoenix, AZ, a mixed-use development is nearing completion. A single level basement for parking underlies five levels above grade. The maximum column and wall loads for the project were 1000 kips and 50 kips per lineal foot, respectively. Fore Green Development is the owner of the project. A combination of soil nails, safe soil cut slopes and soldier piles walls were incorporated into the design and construction for the basement level. Heavily loaded basement foundations were stepped upward to the street level foundations, maintaining contact with the native undisturbed soils. The basement level was utilized only for a heavily loaded parking garage. Surrounding the parking garage is a wrap of 5 story apartment structures that are constructed at surface grade on post-tensioned slabs.

Artisan Lofts on Central

A five story multi-family complex was constructed in Phoenix; constructed on post-tensioned slabs.

Banner Good Samaritan Medical Center Additions and New Structures

Drilled shaft foundations with large diameters were utilized to support the at-grade hospital additions.